

WHAT IS CLAIMED IS:

5 *Sub B'* 1. A method of controlling a print operation of an ink jet printer, comprising the steps of:
determining a print head temperature; and
controlling a capping sequence based on the determined print head temperature.

10 2. A method according to Claim 1, wherein the determining step is repeated.

15 3. A method according to Claim 1, wherein the determining step is performed once before the controlling step.

20 *Sub B2* 4. A method of controlling a print operation of an ink jet printer, comprising the steps of:
cooling a print head using a predetermined method; and
capping the print head after the print head is cooled.

25 5. A method according to Claim 4, wherein the cooling step causes ink droplets to be ejected from the print head.

30 *Sub B3* 6. A method according to Claim 5, wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

35 *Sub A'* ~~7. A method of controlling a print operation of an ink jet printer, comprising the steps of:
printing an image using a print head; and~~

*Cont'd
Sub. A1*

cooling the print head after the end of the printing operation using a predetermined method.

Sub. A1

~~8. A method according to Claim 7, wherein~~
5 the cooling step causes ink droplets to be ejected from the print head.

Sub. A1

9. A method according to Claim 8, wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

Sub. A1

10. A method of controlling a print operation of an ink jet printer, comprising the steps of:

15 obtaining a parameter corresponding to a print head temperature when the ink jet printer is down; and

performing a predetermined process based on the parameter.

20 11. A method according to Claim 10, wherein the parameter is obtained by a calculation, without using a measured actual temperature.

25 12. A method according to Claim 10, wherein the parameter is obtained directly from a measured actual temperature.

30 13. A method according to Claim 10, wherein the predetermined process occurs in a next print job performed by the ink jet printer.

35 14. A method according to Claim 10, wherein the predetermined process occurs at a next power-on for the ink jet printer.

15. A method according to Claim 10,
wherein the predetermined process occurs at an end
of a current print job.

5 16. A method according to Claim 10,
wherein the predetermined process is determined
based on whether a print head is capped or not.

10 17. A method according to Claim 10,
wherein the predetermined process comprises changing
a number of ink droplets ejected before a print job.

15 18. A method according to Claim 10,
wherein the predetermined process comprises purging
ink from the print head.

19. A method of cooling a print head of an
ink jet printer before capping, comprising the steps
of:
20 determining an ambient temperature;
 determining a print head temperature after
receipt of last print data for a print job;
 waiting a predetermined time after receipt
of the last print data for the print job;
25 after waiting the predetermined time,
ejecting a predetermined number of ink droplets from
nozzles of the print head at a frequency lower than
a frequency used for printing;
 determining a drop in print head
30 temperature caused by ejecting the predetermined
number of ink droplets; and
 repeating the steps of waiting a
predetermined time and ejecting a predetermined
number of ink droplets until the print head
35 temperature falls below a threshold.

20. A method according to Claim 19,
wherein the ambient temperature is determined by
using a diode disposed in the ink jet printer.

5 21. A method according to Claim 19,
wherein the print head temperature after receipt of
the last print data for the print job is determined
by using a calculation based on a number of ink
droplets ejected from the print head during the
10 print job.

22. A method according to Claim 19,
wherein the print head temperature after receipt of
the last print data for the print job is determined
15 by using a diode disposed on the print head.

23. A method according to Claim 19,
wherein the predetermined time for waiting after
receipt of the last print data for the print job is
20 between nine and twelve seconds.

24. A method according to Claim 19,
wherein the predetermined number of ink droplets
ejected from nozzles of the print head is thirty per
25 nozzle.

25. A method according to Claim 19,
wherein the frequency that the predetermined number
of droplets are ejected from the print head is
30 approximately two kilohertz, and the frequency used
for printing is at least five kilohertz.

26. A method according to Claim 19,
wherein the drop in print head temperature caused by
35 ejecting the predetermined number of ink droplets is
determined by using a calculation based on the
predetermined number of ink droplets ejected and the

frequency that the ink droplets are ejected from the print head.

5 27. A method according to Claim 19,
wherein the drop in print head temperature caused by
ejecting the predetermined number of ink droplets is
determined by using a diode disposed on the print
head.

10 28. A method according to Claim 19,
further comprising the step of purging ink from the
print head in a case that the method of Claim 19 is
interrupted before the print head temperature has
fallen below the threshold.

15 29. A method of cooling a print head of an
ink jet printer, comprising the step of repeatedly
ejecting a predetermined number of ink droplets from
nozzles of the print head at a frequency lower than
20 a frequency used for printing, with a pause between
each repetition, until a predetermined threshold is
reached.

25 30. An apparatus for controlling a print
operation of an ink jet printer, comprising:
a memory including a region for storing
executable process steps;
a processor for executing the executable
process steps; and
30 an interface between the processor and a
print head of the ink jet printer that allows the
processor to control firing of nozzles of the print
head,
wherein the executable process steps
35 include steps of: (a) determining a print head
temperature; and (b) controlling a capping sequence
based on the determined print head temperature.

31. An apparatus according to Claim 30, wherein the determining step is repeated.

5 32. An apparatus according to Claim 30, wherein the determining step is performed once before the controlling step.

10 *Sub 200*
33. An apparatus for controlling a print operation of an ink jet printer, comprising:
a memory including a region for storing executable process steps;
a processor for executing the executable process steps; and
15 an interface between the processor and a print head of the ink jet printer that allows the processor to control firing of nozzles of the print head,
wherein the executable process steps include steps of: (a) cooling the print head using
20 a predetermined method; and (b) capping the print head after the print head is cooled.

25 34. An apparatus according to Claim 33, wherein the cooling step causes ink droplets to be ejected from the print head.

Sub 200
35. An apparatus according to Claim 34, wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

30 *Sub 202*
36. An apparatus for controlling a print operation of an ink jet printer, comprising:
a memory including a region for storing executable process steps;
35 a processor for executing the executable process steps; and

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from 90*

an interface between the processor and a print head of the ink jet printer that allows the processor to control firing of nozzles of the print head,

5 wherein the executable process steps include steps of: (a) printing an image using the print head; and (b) cooling the print head after the end of the printing operation using a predetermined method.

10 37. An apparatus according to Claim 36, wherein the cooling step causes ink droplets to be ejected from the print head.

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15 38. An apparatus according to Claim 37, wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

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20 39. An apparatus for controlling a print operation of an ink jet printer, comprising:
a memory including a region for storing executable process steps;

a processor for executing the executable process steps; and

25 an interface between the processor and a print head of the ink jet printer that allows the processor to control firing of nozzles of the print head,

30 wherein the executable process steps include steps of: (a) obtaining a parameter corresponding to a print head temperature when the ink jet printer is down; and (b) performing a predetermined process based on the parameter.

35 40. An apparatus according to Claim 39, wherein the parameter is obtained by a calculation, without using a measured actual temperature.

41. An apparatus according to Claim 39, wherein the parameter is obtained directly from a measured actual temperature.

5 42. An apparatus according to Claim 39, wherein the predetermined process occurs in a next print job performed by the ink jet printer.

10 43. An apparatus according to Claim 39, wherein the predetermined process occurs at a next power-on for the ink jet printer.

15 44. An apparatus according to Claim 39, wherein the predetermined process occurs at an end of a current print job.

20 45. An apparatus according to Claim 39, wherein the predetermined process is determined based on whether the print head is capped or not.

 46. An apparatus according to Claim 39, wherein the predetermined process comprises changing a number of ink droplets ejected before a print job.

25 47. An apparatus according to Claim 39, wherein the predetermined process comprises purging ink from the print head.

30 48. An apparatus for controlling cooling of a print head of an ink jet printer before capping, comprising:

 a memory including a region for storing executable process steps;

35 a processor for executing the executable process steps; and

 an interface between the processor and a print head of the ink jet printer that allows the

processor to control firing of nozzles of the print head,

wherein the executable process steps include steps of: (a) determining an ambient
5 temperature; (b) determining a print head temperature after receipt of a last print data for a print job; (c) waiting a predetermined time after receipt of the last print data for the print job;
10 (d) after waiting the predetermined time, ejecting a predetermined number of ink droplets from nozzles of the print head at a frequency lower than a frequency used for printing; (e) determining a drop in print head temperature caused by ejecting the
15 predetermined number of ink droplets; and (f) repeating the steps of waiting a predetermined time and ejecting a predetermined number of ink droplets until the print head temperature falls below a threshold.

20 49. An apparatus according to Claim 48, wherein the ambient temperature is determined by using a diode disposed in the ink jet printer.

25 50. An apparatus according to Claim 48, wherein the print head temperature after receipt of the last print data for the print job is determined by using a calculation based on a number of ink droplets ejected from the print head during the
30 print job.

35 51. An apparatus according to Claim 48, wherein the print head temperature after receipt of the last print data for the print job is determined by using a diode disposed on the print head.

52. An apparatus according to Claim 48, wherein the predetermined time for waiting after

receipt of the last print data for the print job is between nine and twelve seconds.

53. An apparatus according to Claim 48,
5 wherein the predetermined number of ink droplets ejected from nozzles of the print head is thirty per nozzle.

54. An apparatus according to Claim 48,
10 wherein the frequency that the predetermined number of droplets are ejected from the print head is approximately two kilohertz, and the frequency used for printing is at least five thousand hertz.

55. An apparatus according to Claim 48,
15 wherein the drop in print head temperature caused by ejecting the predetermined number of ink droplets is determined by using a calculation based on the predetermined number of ink droplets ejected and the
20 frequency that the ink droplets are ejected from the print head.

56. An apparatus according to Claim 48,
25 wherein the drop in print head temperature caused by ejecting the predetermined number of ink droplets is determined by using a diode disposed on the print head.

57. An apparatus according to Claim 48,
30 further comprising the step of purging ink from the print head in a case that the process steps of Claim 48 are interrupted before the print head temperature has fallen below the threshold.

58. An apparatus for controlling cooling a
35 print head of an ink jet printer, comprising:

a memory including a region for storing executable process steps;

a processor for executing the executable process steps; and

5 an interface between the processor and a print head of the ink jet printer that allows the processor to control firing of nozzles of the print head;

10 wherein the executable process steps include the step of repeatedly ejecting a predetermined number of ink droplets from nozzles of the print head at a frequency lower than a frequency used for printing, with a pause between each repetition, until a predetermined threshold is
15 reached.

20 *Sub B9* 59. Computer-executable process steps stored on a computer-readable medium, the computer executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:
code to determine a print head temperature;
and
code to control a capping sequence based on
25 the determined print head temperature.

30 60. Computer-executable process steps according to Claim 59, wherein the code to determine a print head temperature is executed repeatedly.

35 61. Computer-executable process steps according to Claim 59, wherein code to determine a print head temperature is executed once before the code to control the capping sequence.

Sub B10 62. Computer-executable process steps stored on a computer-readable medium, the computer

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executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

- 5 code to cool a print head using a predetermined method; and
 code to cap the print head after the print head is cooled.

- 10 63. Computer-executable process steps according to Claim 62, wherein the code to cool the print head causes ink droplets to be ejected from the print head.

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B21

64. Computer-executable process steps according to Claim 63, wherein the ink droplets are ejected at a frequency lower than a frequency used for printing.

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B23

- 20 65. Computer-executable process steps stored on a computer-readable medium, the computer executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:
25 code to print an image using a print head;
 and
 code to cool the print head after the end of the printing operation using a predetermined method.

- 30 66. Computer-executable process steps according to Claim 65, wherein the code to cool the print head causes ink droplets to be ejected from the print head.

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35 67. Computer-executable process steps according to Claim 66, wherein the ink droplets are

Sub 5
ejected at a frequency lower than a frequency used
for printing.

Sub 5
~~68. Computer-executable process steps~~

stored on a computer-readable medium, the computer
executable process steps to control a print
operation of an ink jet printer, the computer-
executable process steps comprising:

code to obtain a parameter corresponding to
a print head temperature when the ink jet printer is
down; and

code to perform a predetermined process
~~based on the parameter.~~

69. Computer-executable process steps

according to Claim 68, wherein the parameter is
obtained by a calculation, without using a measured
actual temperature.

70. Computer-executable process steps

according to Claim 68, wherein the parameter is
obtained directly from a measured actual
temperature.

71. Computer-executable process steps

according to Claim 68, wherein the predetermined
process occurs in a next print job performed by the
ink jet printer.

72. Computer-executable process steps

according to Claim 68, wherein the predetermined
process occurs at a next power-on for the ink jet
printer.

73. Computer-executable process steps

according to Claim 68, wherein the predetermined
process occurs at an end of a current print job.

74. Computer-executable process steps according to Claim 68, wherein the predetermined process is determined based on whether a print head is capped or not.

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75. Computer-executable process steps according to Claim 68, wherein the predetermined process comprises changing a number of ink droplets ejected before a print job.

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76. Computer-executable process steps according to Claim 68, wherein the predetermined process comprises purging ink from the print head.

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77. Computer-executable process steps stored on a computer-readable medium, the computer executable process steps to control cooling of a print head of an ink jet printer before capping, the computer-executable process steps comprising:

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code to determine an ambient temperature;
code to determine a print head temperature after receipt of a last print data for a print job;

code to wait a predetermined time after receipt of the last print data for the print job;

25

code to eject a predetermined number of ink droplets from nozzles of the print head at a frequency lower than a frequency used for printing;

code to determine a drop in print head temperature caused by ejecting the predetermined number of ink droplets; and

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code to repeat execution of the code to wait a predetermined time and the code to eject a predetermined number of ink droplets until the print head temperature falls below a threshold.

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78. Computer-executable process steps according to Claim 77, wherein the ambient

temperature is determined by using a diode disposed in the ink jet printer.

5 79. Computer-executable process steps
according to Claim 77, wherein the print head
temperature after receipt of the last print data for
the print job is determined by using a calculation
based on a number of ink droplets ejected from the
print head during the print job.

10 80. Computer-executable process steps
according to Claim 77, wherein the print head
temperature after receipt of the last print data for
the print job is determined by using a diode
15 disposed on the print head.

20 81. Computer-executable process steps
according to Claim 77, wherein the predetermined
time for waiting after receipt of the last print
data for the print job is between nine and twelve
seconds.

25 82. Computer-executable process steps
according to Claim 77, wherein the predetermined
number of ink droplets ejected from nozzles of the
print head is thirty per nozzle.

30 83. Computer-executable process steps
according to Claim 77, wherein the frequency that
the predetermined number of droplets are ejected
from the print head is approximately two kilohertz,
and the frequency used for printing is at least five
thousand hertz.

35 84. Computer-executable process steps
according to Claim 77, wherein the drop in print
head temperature caused by ejecting the

predetermined number of ink droplets is determined by using a calculation based on the predetermined number of ink droplets ejected and the frequency that the ink droplets are ejected from the print head.

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85. Computer-executable process steps according to Claim 77, wherein the drop in print head temperature caused by ejecting the predetermined number of ink droplets is determined by using a diode disposed on the print head.

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86. Computer-executable process steps according to Claim 77, further comprising code to purge ink from the print head in a case that the execution of the computer-executable process steps of Claim 77 are interrupted before the print head temperature has fallen below the threshold.

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87. Computer-executable process steps stored on a computer-readable medium, the computer executable process steps to control cooling of a print head of an ink jet printer, the computer-executable process steps comprising code to repeatedly eject a predetermined number of ink droplets from nozzles of the print head at a frequency lower than a frequency used for printing, with a pause between each repetition, until a predetermined threshold is reached.

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88. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

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a determining step to determine a print head temperature; and

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B12

a controlling step to control a capping sequence based on the determined print head temperature.

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89. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

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a cooling step to cool a print head using a predetermined method; and

a capping step to cap the print head after the print head is cooled.

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~~90. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:~~

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~~a printing step to print an image using a print head; and~~

~~a cooling step to cool the print head after the end of the printing operation using a predetermined method.~~

25

91. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control a print operation of an ink jet printer, the computer-executable process steps comprising:

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an obtaining step to obtain a parameter corresponding to a print head temperature when the ink jet printer is down; and

35

a performing step to perform a predetermined process based on the parameter.

92. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control cooling of a print head of an ink jet printer before capping, the computer-executable process steps comprising:

a first determining step to determine an ambient temperature;

a second determining step to determine a print head temperature after receipt of a last print data for a print job;

a waiting step to wait a predetermined time after receipt of the last print data for the print job;

an ejecting step to eject a predetermined number of ink droplets from nozzles of the print head at a frequency lower than a frequency used for printing;

a third determining step to determine a drop in print head temperature caused by ejecting the predetermined number of ink droplets; and

a repeating step to repeat the waiting step to wait a predetermined time and the ejecting step to eject a predetermined number of ink droplets.

93. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to control cooling of a print head of an ink jet printer, the computer-executable process steps comprising the step of repeatedly ejecting a predetermined number of ink droplets from nozzles of the print head at a frequency lower than a frequency used for printing, with a pause between each repetition, until a predetermined threshold is reached.